KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS:_____ DATE : May 31st,2012

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX43D51VC0CAA

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ACCEPTED BY:_____ PROPOSED BY: Elton Liu

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 17” SXGA amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R (red), G (green), B (blue) sequentially. This display is RoHS compliant, TCP (Tape Carrier Package) technology and LED backlight are applied on this display.

Part Name	TX43D51VC0CAA
Module Dimensions	368.0(W) mm x 306.0(H) mm x 19.9 (D) mm typ.
LCD Active Area	337.92(W) mm x 270.336(H) mm
Pixel Pitch	0.264(W) mm x 0.264 (H) mm
Resolution	1280 x 3(RGB)(W) x 1024(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Mode; Normally Black Mode
Display Type	Active Matrix
Number of Colors	16.7M Colors
Backlight	Edge Light Type with White LED
Weight	1600 typ. (g)
Interface	2-channel LVDS (LVDS:Low Voltage Differential Signaling)
Power Supply Voltage	5V for LCD; 12V for Backlight
Viewing Direction	Super Wide Version (In-Plane Switching)

3.2 APPLICATION AND OTHERS

(1) This LCD module was designed and manufactured to be used in an air-conditioned room away from direct sunlight.

(2) This LCD module cannot be applied to an instrument which requires extremely high reliability and safety from its functions and precision. These instruments include medical equipment which affects life- and/or wealth-support apparatus.

(3) Any problems caused by a use with deviation from the conditions mentioned in this specification are not included in the warranty.

(4) Maintenance
This LCD module and the aforementioned data may be changed without notice. When you demand maintenance parts, please inquire about the changes in advance.

(5) Repair
We will replace or repair all defective modules if the relevant defect is caused by KOE. However, we will not take any responsibilities for defective modules after the expiration of warranty period. Also, if you access the modules for repairs, we will not warrant them either even if it is within the warranty period.

(6) Items in this specification may be changed for improvement without prior notice. Please consult our sales division before engineering an instrument with this LCD module.

(7) When a question arises concerning the specification, please contact our sales division.

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	VDD	0	6	V	-
Input Voltage of Logic	VI	-0.3	3.4	V	Note 1
Operating Temperature	Top	0	50	°C	Note 2
Storage Temperature	Tst	-20	60	°C	Note 2
Backlight Input Voltage	VLED	0	(18)	V	-

Note 1: It is applied to except LVDS signal.

Note 2: Temperature and Humidity should be applied to the center glass surface of TFT module, not to the system installed with a module. The temperature at the center of rear surface should be less than 60°C on the condition of operating.

Function of module is guaranteed in above operating temperature range, but optical characteristics is specified for only 25°C operating condition.

5. ELECTRICAL CHARACTERISTICS

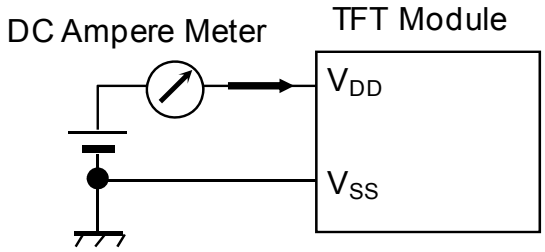
5.1 LCD CHARACTERISTICS

$T_a = 25\ ^{\circ}C,\ \mathrm{VSS} = 0\mathrm{V}$

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	VDD	4.5	5	5.5	V	-
Input Voltage of Logic	VI	-0.3	-	3.4	V	Note 1
Power Supply Current	IDD	-	610	750	mA	Note 2
Vsync Frequency	f_v	-	60	76	Hz	-
Hsync Frequency	f_H	-	64	66	KHz	-
CLK Frequency	f_{CLK}	40	54	67.5	MHz	-

Note 1: It is applied to except LVDS signal.

Note 2: DC current at fv=60.0Hz, fCLK=54MHz and VDD=5.0V



Note 3: Current capacity of power supply for VDD should be larger than 5A, so that the fuse can be opened at the trouble of power supply.

Note 4: The picture on maximum current is white picture.

5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25\ ^{\circ}C$

Item		Symbol		Min.	Typ.	Max.	Unit	Remarks
Input Voltage		Vin		10.8	12.0	13.2	V	-
Input Current		Iin		-	(1.2)	1.44	A	-
ON/OFF Control Voltage	ON	ON/OFF		2.5	-	5.0	V	B/L=ON
	OFF			0	-	0.5	V	B/L=OFF
Brightness Control Voltage		Vbc		1.0	-	3.6	V	Note 1,2
PWM dimming signal Input Voltage		PWM	High	2.9	-	5.0	V	Note 3
			Low	0	-	0.8	V	-
PWM Frequency		PWMf		140	150	160	Hz	-

Note 1: VIN=12.0V, VBC=3.3V or PWMf=150Hz and display pattern is a full White (Gray scale = 255 level).

Note 2: A protection fuse (3.0A) is built into this module. Current capacity of the power supply for Vin should be greater than 8.0A, so that the fuse can 'blow' if there is a problem with the power supply.

Note 3: Brightness Control (Reference value)

Vbc(Typ.)	Brightness
1.0V	20%
1.3V	30%
1.5V	40%
1.8V	50%
2.0V	60%
2.3V	70%
2.5V	80%
2.8V	90%
Above3.0V	100%

Note 4: Brightness Control (Reference value)

PWM(Typ.)	Brightness
5%	5%
10%	10%
20%	20%
30%	30%
40%	40%
50%	50%
60%	60%
70%	70%
80%	80%
90%	90%
100%	100%

Note 5: 9mA inrush current flow for 40 μs when duty turned on (Switched from low to high).

6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25°C,VDD=5.0V,fv=60Hz.
- In the dark room around 500~1000 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$T_a = 25\ ^{\circ}C,\ f_v = 60\ \text{Hz},\ \text{VDD} = 12V$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		Bwh	$\theta = 0^{\circ}$	280	350	-	cd/m^2	Note 1,2
Brightness Uniformity		Buni		75	-	-	%	Note 3
Contrast Ratio		CR		600	1000	-	-	Note 4
Response Time		Rise	ton	-	10	18	ms	Note 5
		Fall	tof	-	12	20		
Color Chromaticity	Red	X	$\theta = 0^{\circ}$	0.621	0.651	0.681	-	Note 6
		Y		0.296	0.326	0.356		
	Green	X		0.284	0.314	0.344		
		Y		0.581	0.611	0.641		
	Blue	X		0.119	0.149	0.179		
		Y		0.024	0.054	0.084		
	White	X		0.269	0.299	0.329		
		Y		0.285	0.315	0.345		
Contrast Ratio at 85°		CR 85°	$\theta = +85^{\circ}$ $\phi = 0^{\circ},\ 90^{\circ},$ $180^{\circ}, 270^{\circ}$	10	-	-	-	-
NTSC Ratio			$\theta = 0^{\circ}$	-	72	-	%	-

Note 1: The brightness is measured from the panel center point, P5 in Fig. 6.2, for the typical value.

Note 2: Brightness of white is measured by LCM is light up after 30 minutes .

Note 3: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

, which is based on the brightness values of the 9 points measured by CS-1000A as shown in Fig. 6.2.

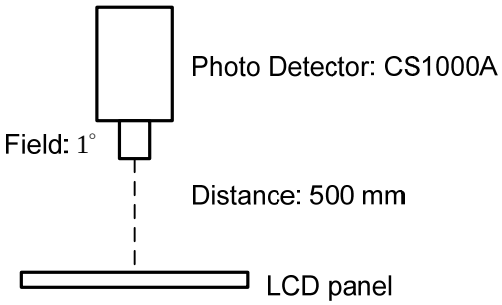


Fig. 6.1

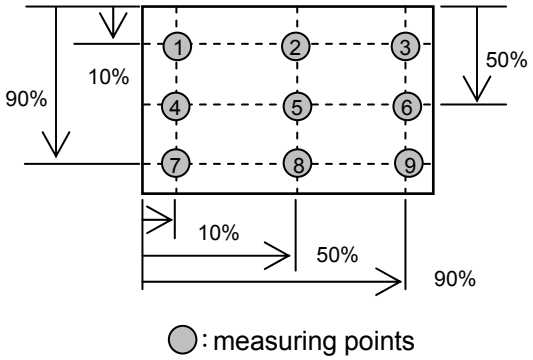


Fig. 6.2

Note 4: The Contrast Ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 5: The definition of response time is shown in Fig. 6.3. The rising time is the period from 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness rising to 10% brightness.

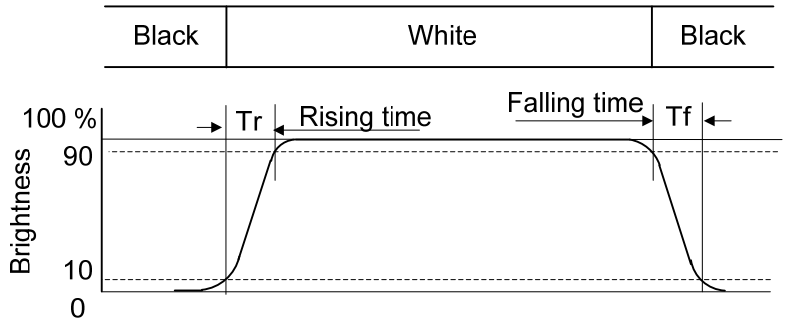
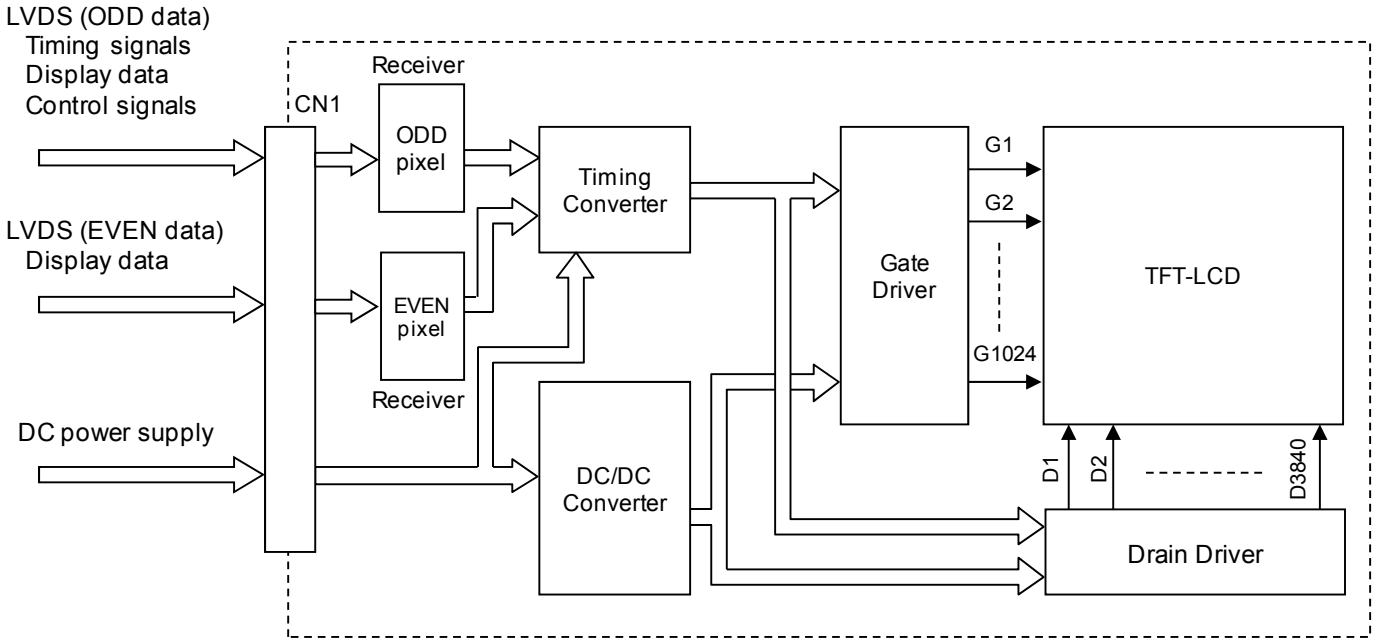


Fig 6.3

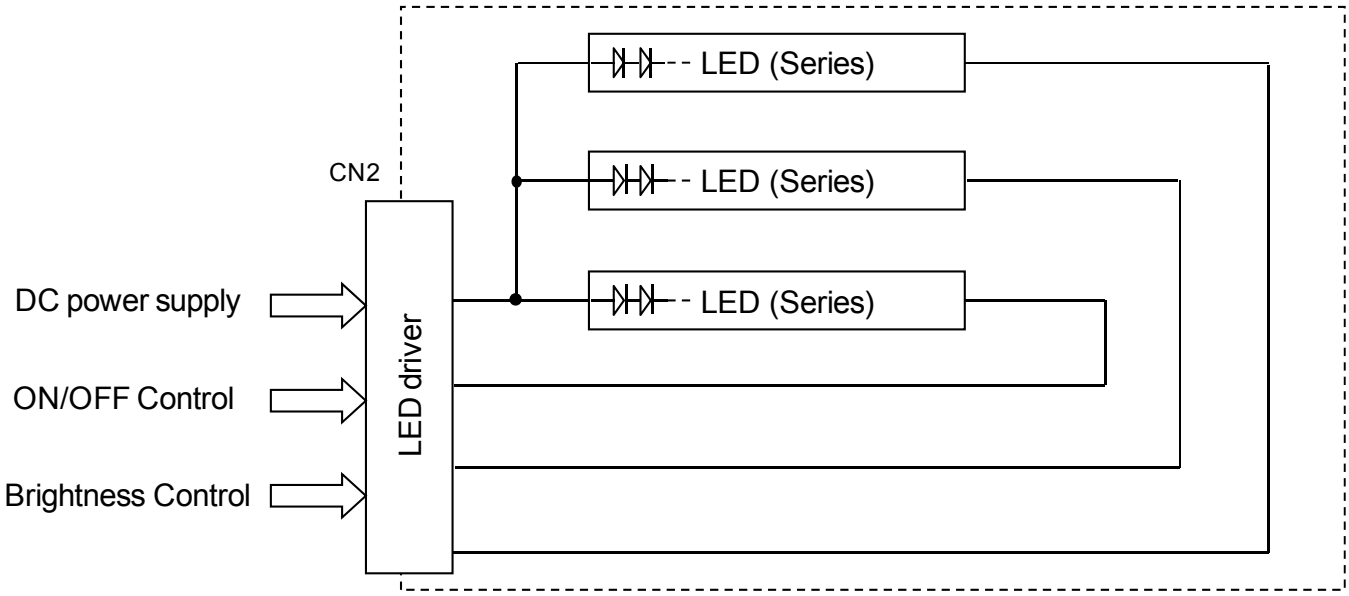
Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM

7.1 TFT Module



7.2 Back light unit



8. INTERFACE PIN ASSIGNMENT

8.1 TFT-LCD MODULE

The display interface connector (CN1) is MDF76GW-30S-1H(55):

(Matching connector: JAE FI-X30H or FI-X30M)

Pin No.	Symbol	Function	Note
1	RAIN0-	ODD pixel data	2)
2	RAIN0+		
3	RAIN1-	ODD pixel data	2)
4	RAIN1+		
5	RAIN2-	ODD pixel data	2)
6	RAIN2+		
7	VSS	GND (0V)	1)
8	RACLKIN-	ODD pixel clock	2)
9	RACLKIN+		
10	RAIN3-	ODD pixel data	2)
11	RAIN3+		
12	RBIN0-	EVEN pixel data	2)
13	RBIN0+		2)
14	VSS	GND (0V)	1)
15	RBIN1-	EVEN pixel data	2)
16	RBIN1+		
17	VSS	GND (0V)	1)
18	RBIN2-	EVEN pixel data	2)
19	RBIN2+		
20	RBCLKIN-	EVEN pixel clock	2)
21	RBCLKIN+		
22	RBIN3-	EVEN pixel data	2)
23	RBIN3+		
24	VSS	GND (0V)	1)
25	NC	No Connection	3)
26	DE	No Connection	3)
27	NC	No Connection	3)
28	VDD	Power Supply (+5.0V)	4)
29	VDD		
30	VDD		

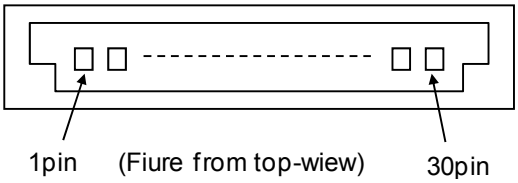
Notes 1) All Vss pins should be grounded.

2) RnINm+ and RnINm– (n=A,B m=0,1,2,3) should be wired by twist-pairs or side-by-side FPC patterns, respectively.

3) Please keep open.

4) All VDD pins should be connected to +5.0 V (typ.).

5) Pin assignment is as follows.



8.2 BACK-LIGHT UNIT

CN2 : TARNG YU Enterprise: TU2001WNR-12S

(Matching connector : JST PHR-12 or TARNG YU Enterprise TU2001HNO-12)

Pin No.	Symbol	Description	Note
1	VIN	Power Supply (typ. 12.0V)	1)
2	VIN		
3	VIN		
4	VIN		
5	ON/OFF	High : Backlight ON, Low : Backlight OFF	4)
6	VSS	GND (0V)	2)
7	VSS		
8	VBC	Brightness Control Signal	5),6)
9	PWM	PWM Dimming Signal	3),6)
10	NC	NC	
11	VSS	GND (0V)	2)
12	VSS		

Notes

1) VIN pins should be connected to +12.0V (Typ.).

2) VSS pins should be grounded. The metal bezel is internally connected to GND.

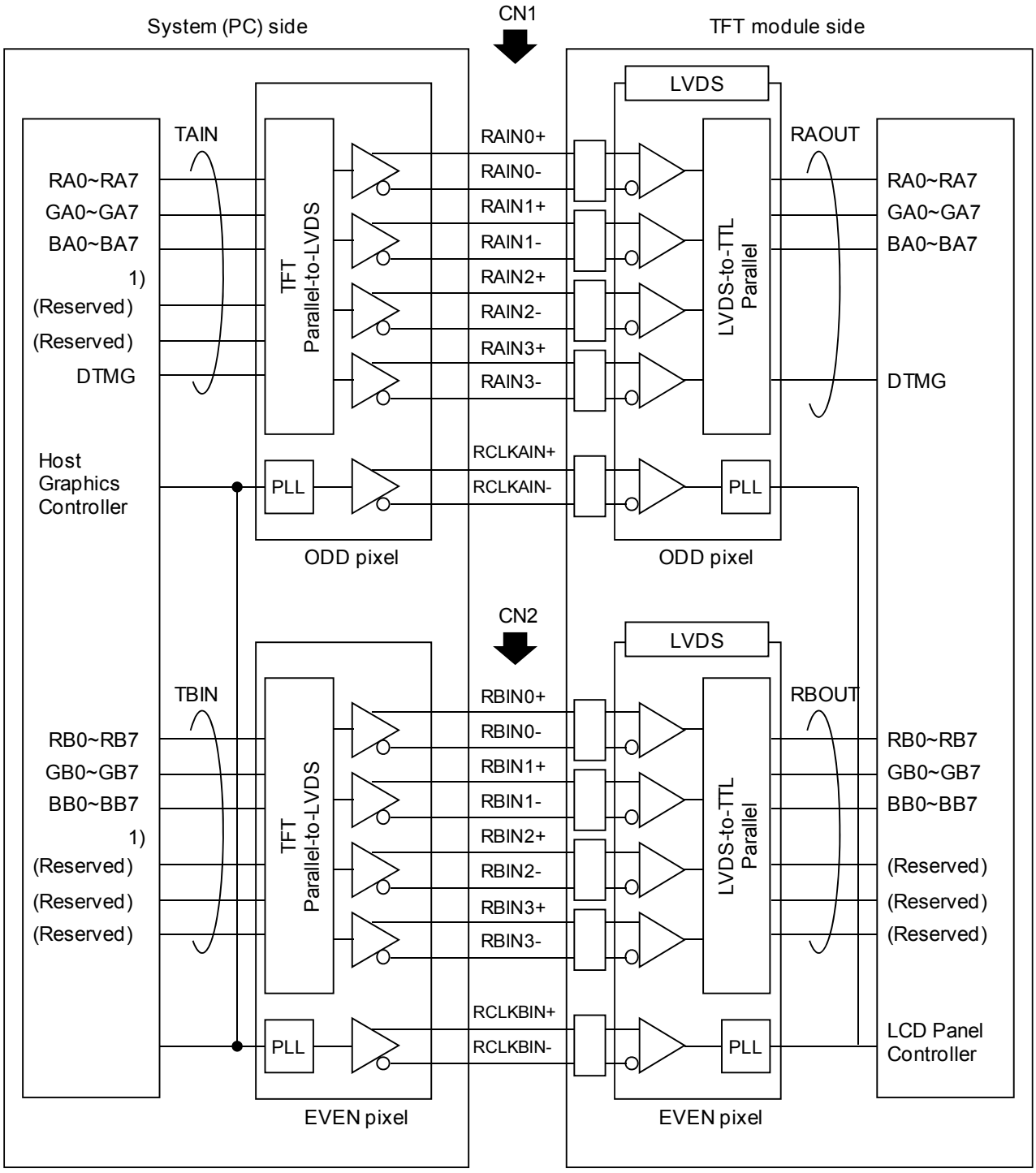
3) High level:2.5~5.0V, Low level:0~0.9V

4) High level:2.5~5.0V, Low level:0~0.5V

5) Input Voltage : 1.0 ~ 3.6V DC(Recommend this Pin function just for testing only)

6) These signals can’t input at the same time.(Please to be set open that do not use of pin)

8.3 BLOCK DIAGRAM OF INTERFACE



RA0~7, RB0~7：R data
GA0~7, GB0~7：G data
BA0~7, RB0~7：B data
DTMG ：Display timing data

Receiver: Equivalent of THC63LVDF84B by THine

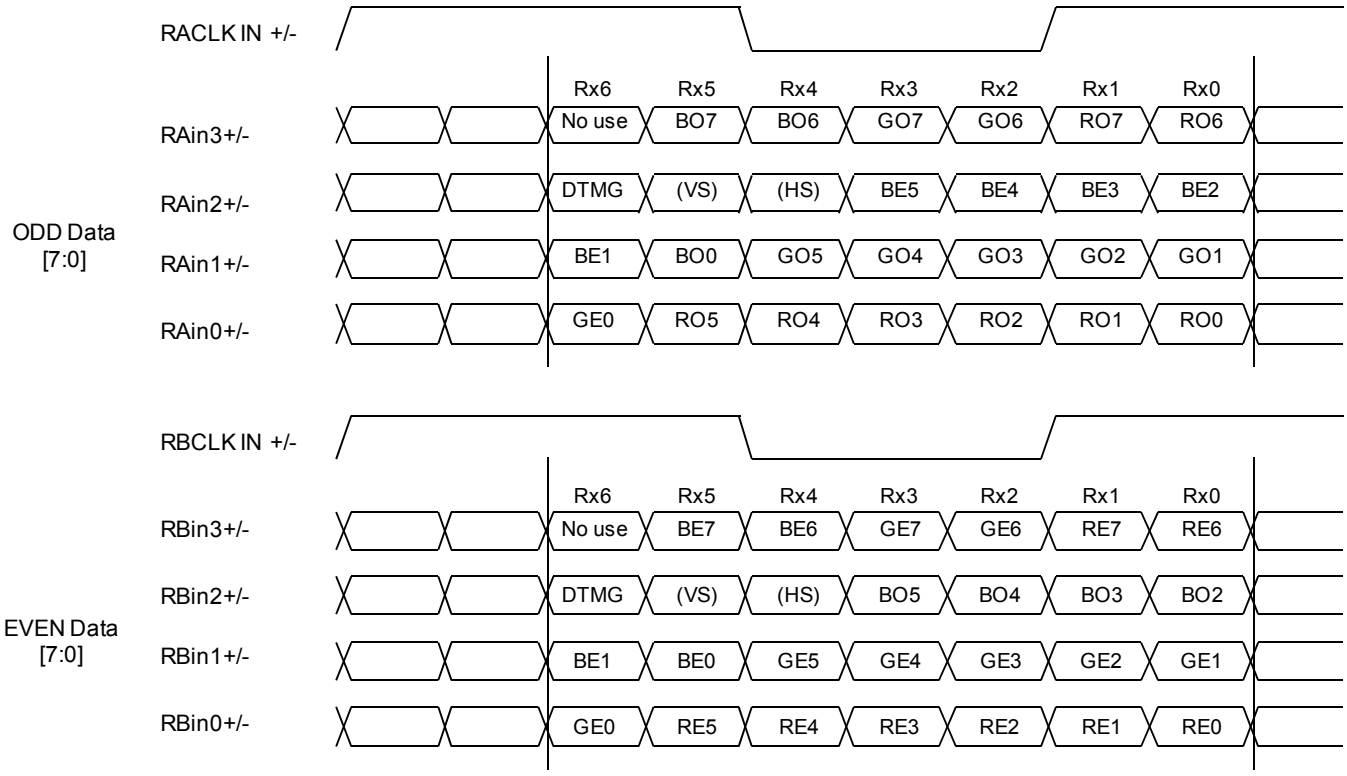
Notes 1) RSVD (reserved) pins on a transmitter should be connected with Vss.

2) The system must have a LVDS transmitter to drive a module.
Moreover, each channel must have a DTMG signal.

3) The impedance of LVDS cable should be 50 ohms per a signal line or about 100 ohms per a twist-pair line when it is used differentially.

8.4 LVDS INTERFACE

8bit Digital



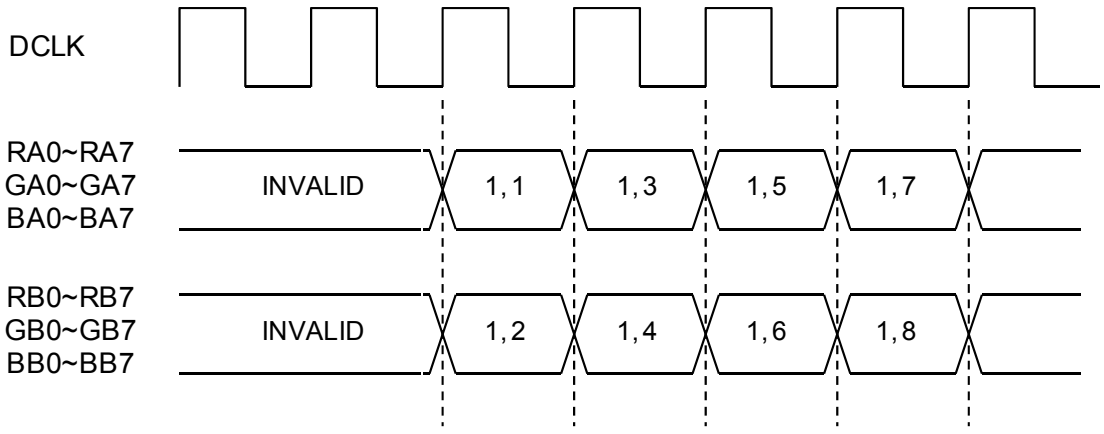
8 bit x 3 LVDS Interface Format

8.5 CORRESPONDENCE BETWEEN INPUT DATA AND DISPLAY IMAGE

RA	(1,1) GA	BA	RB	(1,2) GB	BB

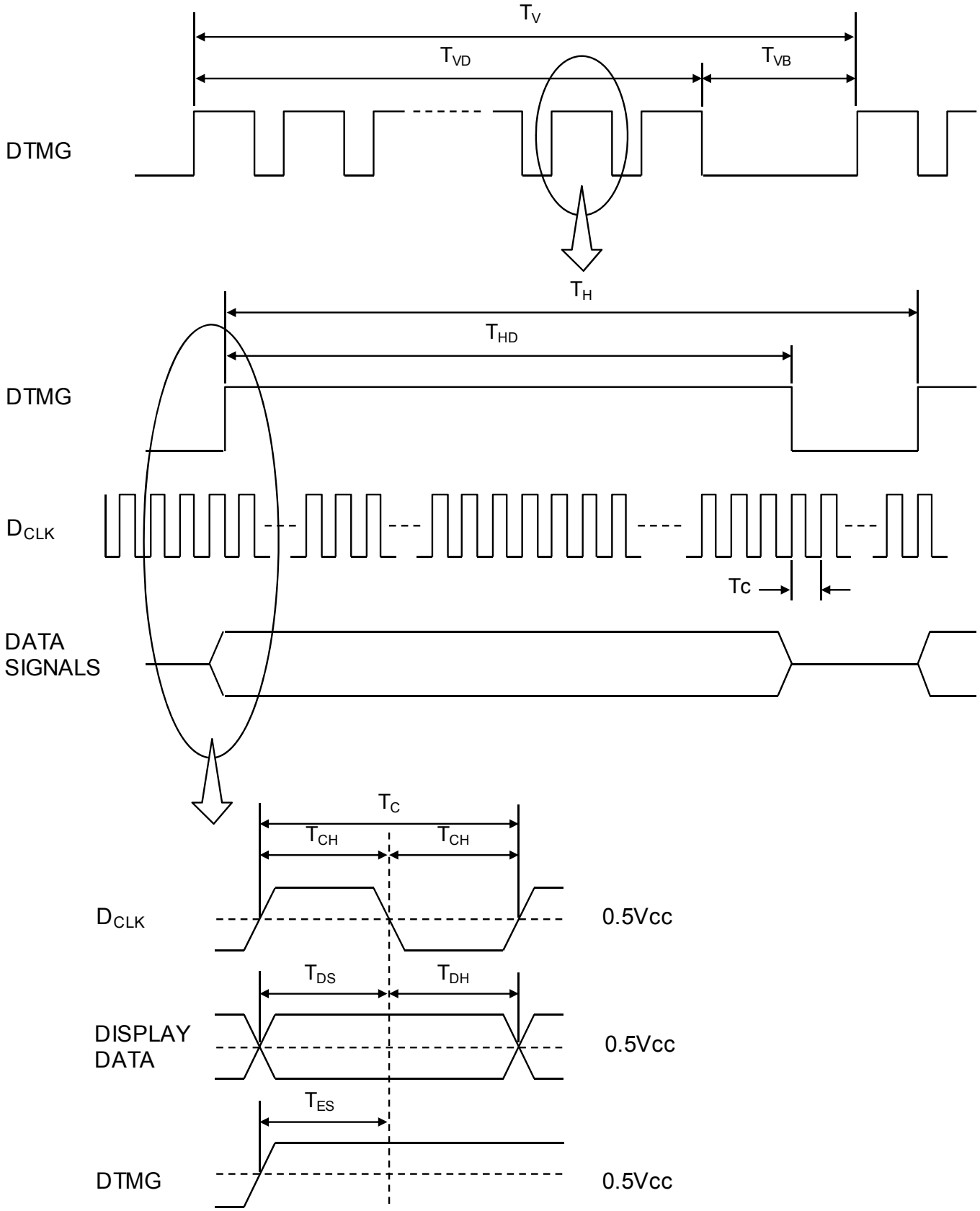
ODD pixel： RA0~RA7：R data
GA0~GA7：G data
BA0~BA7：B data
EVEN pixel：RB0~RB7：R data
GB0~GB7：G data
BB0~BB7：B data

1,1	1,2	1,3	……	1,1280
2,1	2,2	2,3	……	2,1280
3,1	3,2	3,3	……	3,1280
⋮	⋮	⋮		⋮
1024,1	1024,2	1024,3	……	1024,1280



9. TIMING CHART

9.1 TIMING DIAGRAMS OF INTERFACE SIGNAL

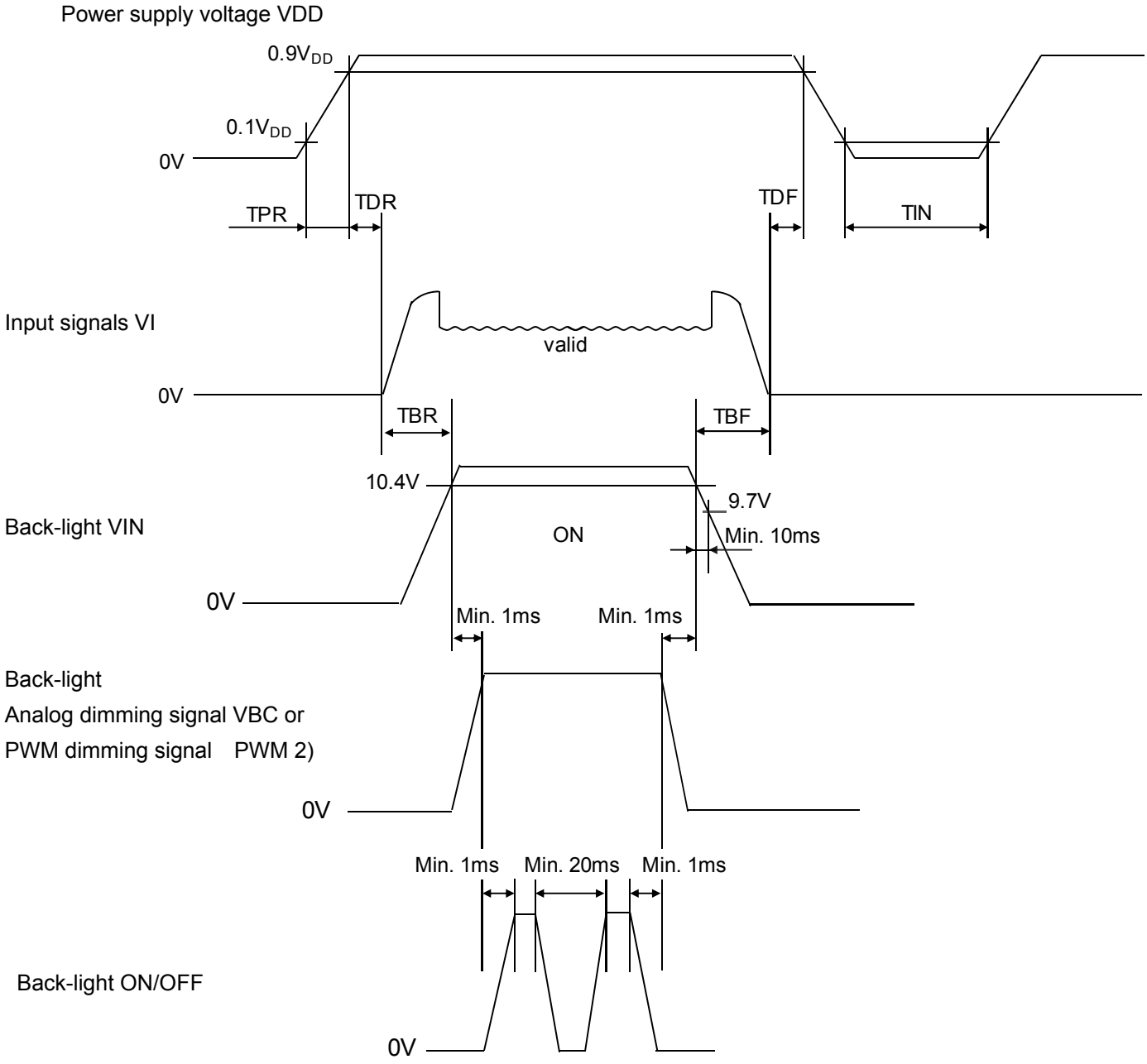


9.2 TIMING PARAMETERS

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	$1/T_C$	40	-	67.5	MHz	-
	High Time	t_{CH}	4	-	-	nsec	
	Low Time	t_{CL}	4	-	-	nsec	
Data	Setup Time	t_{DS}	4	-	-	nsec	
	Hold Time	t_{DH}	4	-	-	nsec	
Data Enable	Setup Time	t_{ES}	4	-	-	nsec	
Frame Frequency	Cycle	t_V	13.1	16.7	(17.5)	msec	
			1,027	1,066	(1,270)	lines	-
Vertical Active Display Term	Display Period	t_{VD}	1,024	1,024	1,024	lines	-
	Vertical Blank Period	t_{VB}	3	-	-	lines	-
One Line Scanning Time	Cycle	t_H	812	-	(1,080)	clocks	-
Horizontal Active Display Term	Display Period	t_{HD}	640	640	640	clocks	-

Dimensions in parentheses are reference value.

9.3 TIMING BETWEEN INTERFACE SIGNALS AND POWER SUPPLY



Notes 1) Timing of power supply voltage and input signals should be used under the following specifications.

1ms	≦	TPR	≦	10ms
40ms	≦	TDR	≦	50ms
20ms	≦	TDF	≦	50ms
		TIN	≧	1s
		TBR	≧	500ms
		TBF	≧	100ms

2) These signals can't input at the same time.

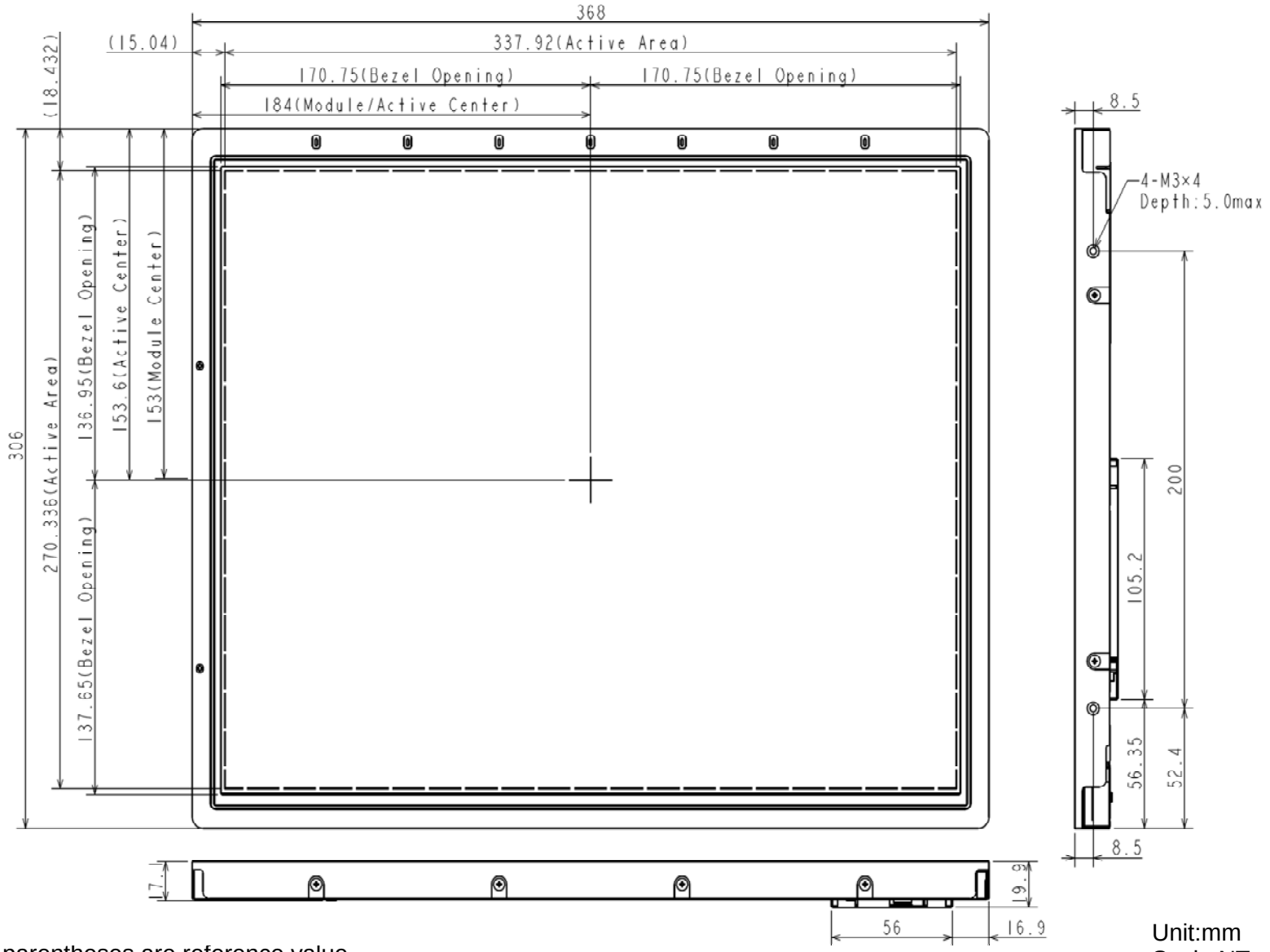
9.4 DATA INPUT for DISPLAY COLOR

Input deta		R data								G data								B data							
		RA7	RA6	RA5	RA4	RA3	RA2	RA1	RA0	GA7	GA6	GA5	GA4	GA3	GA2	GA1	GA0	BA7	BA6	BA5	BA4	BA3	BA2	BA1	BA0
		RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0	GB7	GB6	GB5	GB4	GB3	GB2	GB1	GB0	BB7	BB6	BB5	BB4	BB3	BB2	BB1	BB0
Color		MSB							LSB	MSB							LSB	MSB							LSB
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Red (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Blue (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Notes 1) Definition of gray scale: Color (n)
n indicates gray scale level. Higher n means brighter level.
2) Data signals: 1: High, 0: Low

10. OUTLINE DIMENSIONS

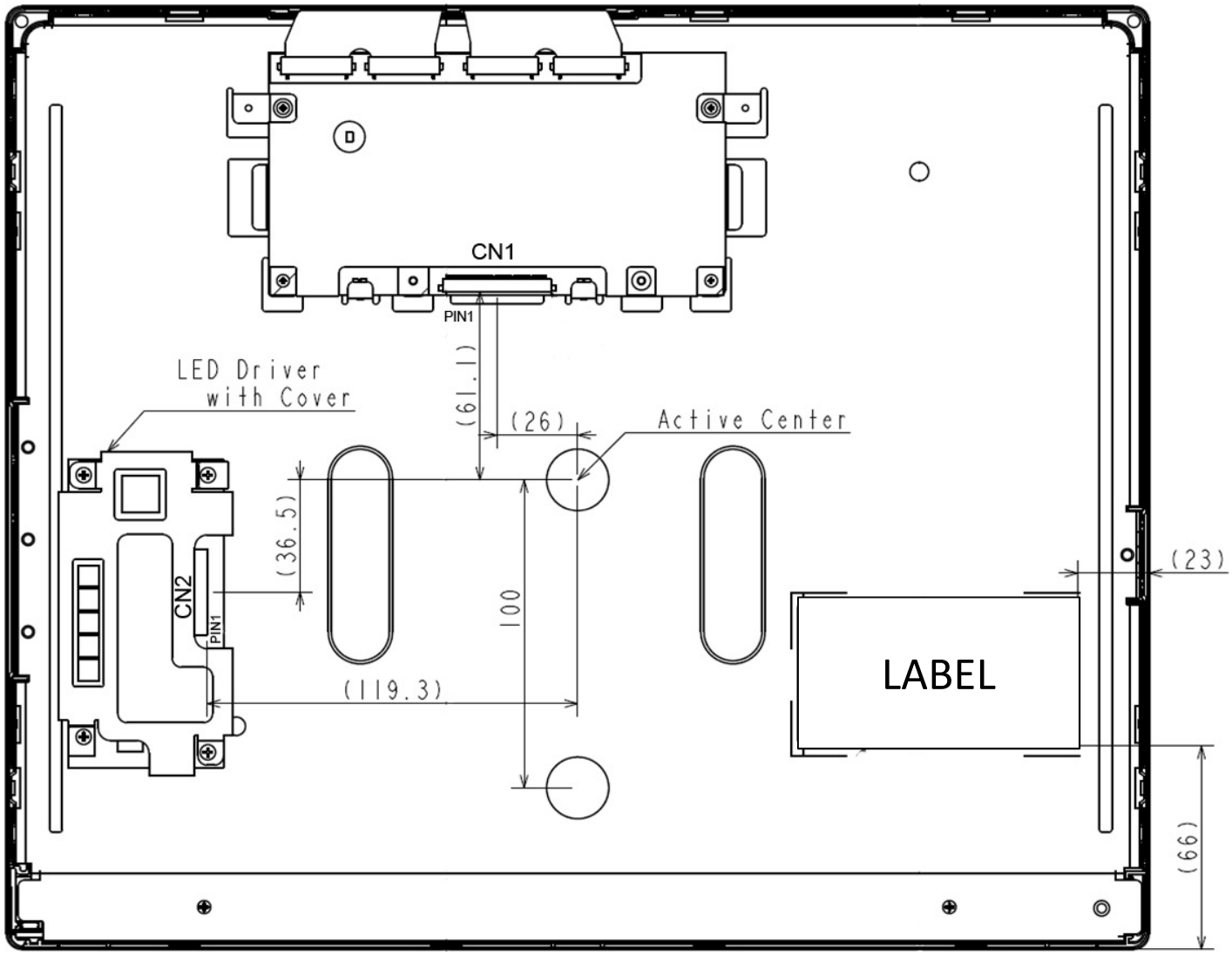
10.1 FRONT VIEW



Unit:mm
Scale:NT

Note 1) Dimension in parentheses are reference value.
Tolerance not specified is +/- 1.0mm.
Maximum torque for M3 screw: 0.588N-m.

10.2 FRAR VIEW



Note 1) Dimension in parentheses are reference value.
2) Tolerance not specified is +/- 1.0mm.
3) The Position of the LED bar fixation screws.

Unit:mm
Scale:NT

11. APPEARANCE STANDARD

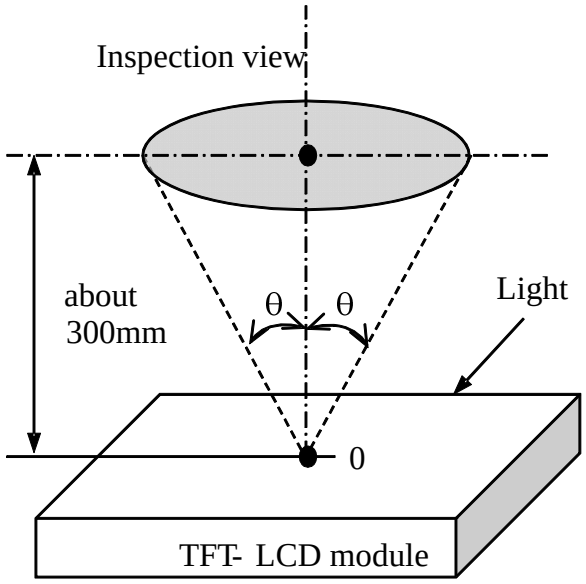
11.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

a) The figure shows the correspondence between eyes (of inspector) and TFT-LCD module.

θ ＜ 45° : when non-operating inspection
θ ＜ 5° : when operating inspection

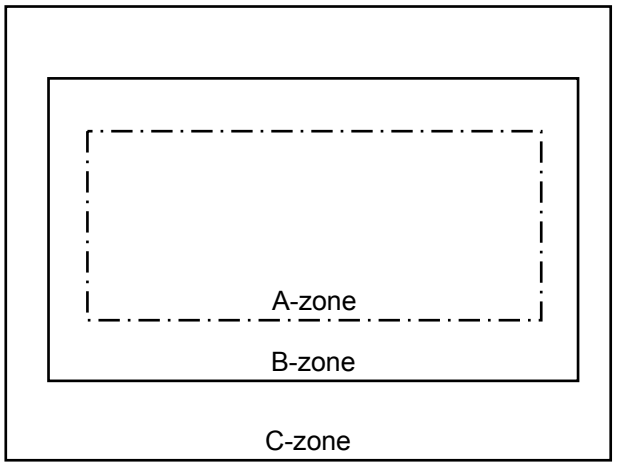
b) Inspection should be executed only from front side and only A-zone.
Cosmetic of B-zone and C-zone are ignore.
(refer to 9.2 DEFINITION OF ZONE)



(2) Environmental

a) Temperature ： 25°C
b) Ambient light ： about 700 lx and non-directive when operating inspection.
：about 1000 lx and non-directive when non-operating inspection.
c) Back-light ：when non-operating inspection, back-light should be off.

11.2 DEFINITION OF ZONE



A-zone ： Display area (pixel area).
B-zone ： Area between A-zone and C-zone.
C-zone ： Metal bezel area.
(Include I/F connector)

11.3 LCD APPEARANCE SPECIFICATION

The specification as below is defined as the amount of unexpected phenomenon or material in different zones of LCD panel. The definitions of length, width and average diameter using in the table are shown in Fig. 11.3 and Fig. 11.4.

Item	Criteria				Applied zone
Scratches	Length (mm)	Width (mm)	Maximum number	Minimum space	A,B
	Ignored	W≦0.02	Ignored	-	
	L≦40	W≦0.04	10	-	
	L≦20	W≦0.08	10	-	
	Round (Dot Shape)				
	Average diameter (mm)		Maximum number	Minimum space	
	D≦0.2		Ignore	-	
	D≦0.6		10	-	
Dent	Serious one is not allowed				A
Wrinkles in polarizer	Serious one is not allowed				A
Bubbles on polarizer	Average diameter (mm)		Maximum number		A
	D≦0.3		Ignored		
	0.3＜D≦0.5		10		
	0.5＜D≦1.0		5		
	1.0＜D		none		
1) Stains 2) Foreign Materials 3) Dark Spot	Filamentous (Line shape)				A,B
	Length (mm)	Width (mm)	Maximum number		
	-	W≦0.02	Ignored		
	L≦4.0	W≦0.04	8		
	L≦2.0	W≦0.08	8		
	-	W＞0.08	Dot Shape		
	Round (Dot shape)				A,B
	Average diameter (mm)	Maximum number	-		
	D≦0.22	Ignored	-		
	D≦0.5	8	-		
	D＞0.5	None	-		
	Those wiped out easily are acceptable				
Dot-Defect (Note 1)		Type	Maximum number		A
	Bright dot-defect	1 dot	5		
		2 adjacent dot	2		
		3 adjacent dot or above	Not allowed		
		In total	5		
	Dark dot-defect	1 dot	8		
		2 adjacent dot	4		
		3 adjacent dot or above	Not allowed		
		In total	8		
	In total		13		

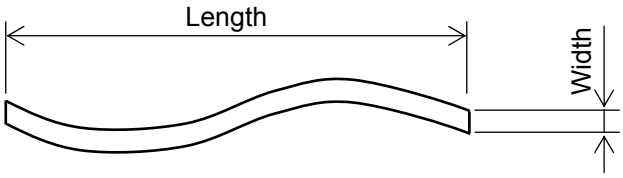
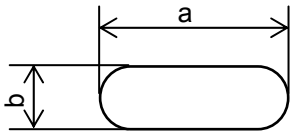


Fig 11.3



Average diameter = $\frac{a+b}{2}$

Fig 11.4

Note 1: The definitions of dot defect are as below:

- The defect area of the dot must be bigger than half of a dot.
- For bright dot-defect, showing black pattern, the dot's brightness must be over 30% brighter than others.
- For dark dot-defect, showing white pattern, the dot's brightness must be under 70% darker than others.
- The definition of 1-dot-defect is the defect-dot, which is isolated and no adjacent defect-dot.
- The definition of adjacent dot is shown as Fig. 11.5.
- The Density of dot defect is defined in the area within diameter ϕ =20mm.

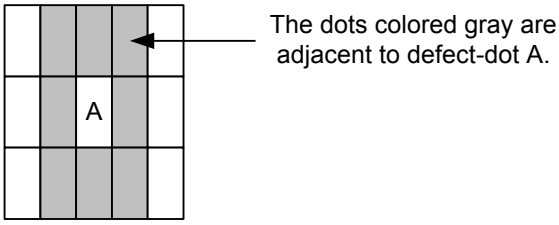


Fig 11.5

Note 2: Polarizer area inside of B-Zone is not applied.

12. PRECAUTIONS

12.1 PRECAUTIONS of ESD

1) Before handling the display, please ensure your body has been connected to ground to avoid any damages by ESD. Also, do not touch display's interface directly when assembling.

2) Please remove the protection film very slowly before turning on the display to avoid generating ESD.

12.2 PRECAUTIONS of HANDLING

1) In order to keep the appearance of display in good condition, please do not rub any surfaces of the displays by sharp tools harder than 3H, especially touch panel, metal frame and polarizer.

2) Please do not pile the displays in order to avoid any scars leaving on the display. In order to avoid any injuries, please pay more attention for the edges of glasses and metal frame, and wear finger cots to protect yourself and the display before working on it.

3) Touching the display area or the terminal pins with bare hand is prohibited. This is because it will stain the display area and cause poor insulation between terminal pins, and might affect display's electrical characteristics furthermore.

4) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean display's surfaces.

5) Please use soft cloth or absorbent cotton with ethanol to clean the display by gently wiping. Moreover, when wiping the display, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the display's surface, especially polarizer.

6) Please wipe any unknown liquids immediately such as saliva, water or dew on the display to avoid color fading or any permanently damages.

7) Maximum pressure to the surface of the display must be less than $1{,}96 \times 10^4$ Pa. If the area of adding pressure is less than $1\ cm^2$, the maximum pressure must be less than 1.96N.

12.3 PRECAUTIONS OF OPERATING

1) Please input signals and voltages to the displays according to the values defined in the section of electrical characteristics to obtain the best performance. Any voltages over than absolute maximum rating will cause permanent damages to this display. Also, any timing of the signals out of this specification would cause unexpected performance.

2) When the display is operating at significant low temperature, the response time will be slower than it at $25\,C^\circ$. In high temperature, the color will be slightly dark and blue compared to original pattern. However, these are temperature-related phenomenon of LCD and it will not cause permanent damages to the display when used within the operating temperature.

3) The use of screen saver or sleep mode is recommended when static images are likely for long periods of time. This is to avoid the possibility of image sticking.

4) Spike noise can cause malfunction of the circuit. The recommended limitation of spike noise is no bigger than $\pm$ 100 mV.

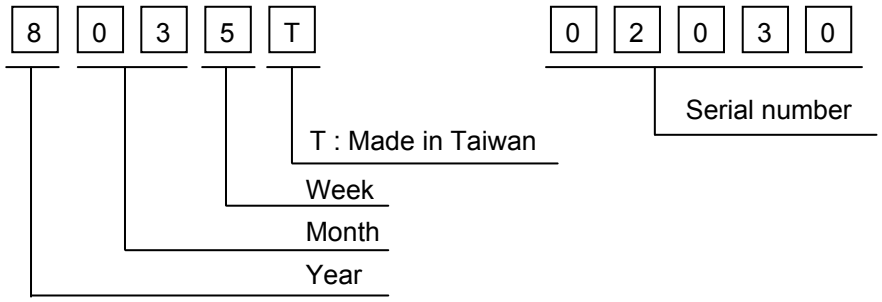
12.4 PRECAUTIONS of STORAGE

If the displays are going to be stored for years, please be aware the following notices.

1) Please store the displays in a dark room to avoid any damages from sunlight and other sources of UV light.
2) The recommended long term storage temperature is between 10℃~35℃ and 55%~75% humidity to avoid causing bubbles between polarizer and LCD glasses, and polarizer peeling from LCD glasses.
3) It would be better to keep the displays in the container, which is shipped from KOE, and do not unpack it.
4) Please do not stick any labels on the display surface for a long time, especially on the polarizer.

13. DESIGNATION OF LOT MARK

1) The lot mark is showing in Fig.13.3. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 5 digits are the serial number.



2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

Year	Mark
2012	2
2013	3
2014	4
2015	5
2016	6

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

Week (Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

3) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

4) The location of the lot mark is on the back of the display shown in Fig. 13.3.

Fig 13.3